

CLAIMS

1. An electro-optic modulator for modulating an optical signal at a wavelength in an input optical path between a first state of transmitting said optical signal into an output optical path and a second state of not transmitting said optical signal into said output optical path, wherein said modulator comprises an active modulating material that comprises an organic free radical compound in at least one of said first and second states.
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2. The electro-optic modulator of claim 1, wherein said organic free radical compound is reflective at said wavelength.
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3. The electro-optic modulator of claim 1, wherein said active modulating material reversibly switches between said first and second states in correspondence with an input electronic signal that encodes binary information.
4. The electro-optic modulator of claim 1, wherein said active modulating material reversibly switches between said first and second states by the injection and removal of electrons.
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5. The electro-optic modulator of claim 1, wherein said active modulating material switches from said first state to said second state by the removal of electrons, and switches from said second state to said first state by the injection of electrons.
- 20 6. The electro-optic modulator of claim 1, wherein said active modulating material is reversibly switched between said first and second states by the application of an electric current.
7. The electro-optic modulator of claim 1, wherein said active modulating material is reversibly switched between said first and second states by the variation of an applied voltage.
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8. The electro-optic modulator of claim 1, wherein said active modulating material does not absorb at said wavelength in said first and said second states.

9. The electro-optic modulator of claim 1, wherein said modulator comprises a reflective stack comprising:
 - (a) two or more active layers comprising said active modulating material having said first and second states and
 - 5 (b) one or more non-reflective and transmissive layers interposed between each of said two or more active layers.
10. The electro-optic modulator of claim 1, wherein said wavelength is in the infrared spectrum.
11. The electro-optic modulator of claim 1, wherein said wavelength is from 1250 nm
10 to 1750 nm.
12. The electro-optic modulator of claim 1, wherein said modulator modulates said optical signal in a wavelength band at least 10 nm in width.
13. The electro-optic modulator of claim 1, wherein said modulator modulates said optical signal in a wavelength band at least 100 nm in width.
- 15 14. The electro-optic modulator of claim 1, wherein said modulator modulates said optical signal in a wavelength band at least 1000 nm in width.
15. The electro-optic modulator of claim 1, wherein said modulator is solid state and has no moving parts, wherein said active modulating material does not move when reversibly switched between said first and second states.
- 20 16. The electro-optic modulator of claim 2, wherein a reflective surface of said second state of said active modulating material is at from 0° to 90° with respect to an input optical signal.
17. The electro-optic modulator of claim 2, wherein a reflective surface of said second state of said active modulating material is at a 45° angle with respect to an input
25 optical signal.

18. The electro-optic modulator of claim 2, wherein a reflective surface of said second state of said active modulating material is at a 90° angle with respect to an input optical signal.
- 5 19. The electro-optic modulator of claim 1, wherein said organic free radical compound in one or both of said first and second states is a salt of an organic free radical cation.
20. The electro-optic modulator of claim 1, wherein said organic free radical compound in one or both of said first and second states is a salt of a non-polymeric organic free radical cation.
- 10 21. The electro-optic modulator of claim 1, wherein said organic free radical in one or both of said first and second states is a salt of an aminium radical cation.
22. An electro-optic modulator for modulating an optical signal at a wavelength in an input optical path between a first state of transmitting said optical signal into an output optical path and a second state of not transmitting said optical signal into
15 said output optical path, wherein said optical modulator comprises an active modulating material that comprises an organic free radical compound in at least one of said first and second states, wherein said organic free radical compound is a salt of an aminium radical cation.
- 20 23. A method of modulating an optical signal at a wavelength, wherein said method comprises the steps of:
- (a) providing an input optical path;
 - (b) providing an output optical path;
 - (c) interposing an optical modulator for modulating an optical signal at a wavelength in said input optical path between a first state of transmitting said
25 optical signal into said output optical path and a second state of not transmitting said optical signal into said output optical path, wherein said modulator comprises an active modulating material that comprises an organic free radical compound in at least one of said first and second states;

- (d) providing an optical signal in said input optical path; and
- (e) reversibly switching said active modulating material between said first and second states to modulate said optical signal in said output optical path.

23. The method of claim 22, wherein said organic free radical compound is reflective at
5 said wavelength.
24. The method of claim 22, wherein said active modulating material reversibly switches between said first and second states in correspondence with an input electronic signal that encodes binary information.
25. The method of claim 22, wherein said reversible switching of said active
10 modulating material between said first and second states is induced by the injection and removal of electrons.
26. The method of claim 22, wherein said active modulating material switches from said first state to said second state by the removal of electrons, and switches from said second state to said first state by the injection of electrons.
- 15 27. The method of claim 22, wherein said reversible switching of said active modulating material between said first and second states is induced by the application of an electric current.
28. The method of claim 22, wherein said active modulating material is reversibly switched between said first and second states by the variation of an applied voltage.
- 20 29. The method of claim 22, wherein said active modulating material does not absorb at said wavelength in said first and said second states.
30. The method of claim 22, wherein said modulator comprises a reflective stack comprising:
 - (a) two or more active layers comprising said active modulating material having
25 said first and second states and

- (b) one or more non-reflective and transmissive layers interposed between each of said two or more active layers.

31. The method of claim 22, wherein said wavelength is in the infrared spectrum.
32. The method of claim 22, wherein said wavelength is from 1250 nm to 1750 nm.
- 5 33. The method of claim 22, wherein said optical signal is modulated in a wavelength band at least 10 nm in width.
34. The method of claim 22, wherein said optical signal is modulated in a wavelength band at least 100 nm in width.
- 10 35. The method of claim 22, wherein said optical signal is modulated in a wavelength band at least 1000 nm in width.
36. The method of claim 22, wherein said modulator is solid state and has no moving parts, wherein said active modulating material does not move when reversibly switched between said first and second states.
- 15 37. The method of claim 23, wherein a reflective surface of said second state of said active material is at an angle from 0° to 90° with respect to said input optical signal.
38. The method of claim 23, wherein a reflective surface of said second state of said active modulating material is at a 45° angle with respect to an input optical signal.
39. The method of claim 23, wherein a reflective surface of said second state of said active modulating material is at a 90° angle with respect to an input optical signal.
- 20 40. The method of claim 22, wherein said organic free radical compound in one or both of said first and second states is a salt of an organic free radical cation.
41. The method of claim 22, wherein said organic free radical compound in one or both of said first and second states is a salt of a non-polymeric organic free radical cation.

42. The method of claim 22, wherein said organic free radical compound in one or both of said first and second states is a salt of an aminium radical cation.